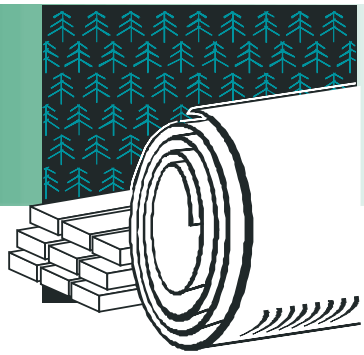
FOREST PRODUCTS

Project Fact Sheet



Molecular Determinants of Carbon Sink Strength in Wood (Continued Project)

Benefits

- Reduced energy consumption in pulping and bleaching operations
- Efficient use of nitrogen and greater stem biomass per unit of nitrogen
- Lower production costs on fiber farms
- Prevention of nitrate run-off into environmentally sensitive areas
- Improvement in yield of hardwood plantations
- Enhanced global competitiveness for U.S. forest industry
- Increased carbon sequestration

Applications

This technology will improve productivity for short rotation hardwoods such as poplar.

Manipulation of Nitrogen- and Carbon-Responsive Genes Can Increase Poplar Productivity

Carbon (C) and nitrogen (N) nutrients must be allocated to the stem of a tree in order for wood to form. This project is identifying genes that control this allocation process. By determining optimum levels of nitrogen and carbon in the stem, researchers can help growers produce trees with enhanced wood properties and reduced processing costs.

In the first phase of the project, researchers discovered how nitrogen fertilization affects wood growth. During the second phase, researchers will identify and genetically manipulate the molecular processeses that control wood formation and wood properties. By developing transgenic trees that fix more carbon into wood growth with a given level of nitrogen, researchers hope to reduce nitrogen fertilizer use. The transgenic trees will also have about a 10% higher cellulose to lignin ratio, resulting in reduced chemical pulping and bleaching time in papermaking operations. Additionally, stronger carbon sink strength will increase carbon sequestration, possibly leading to carbon credits.

Nitrogen Manipulation Alters Poplar Growth

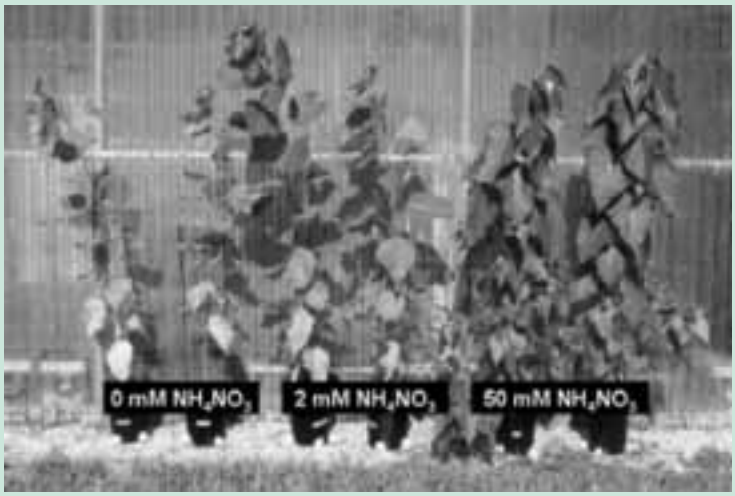


Figure 1. High nitrogen (N) poplars, shown here on the right, have enormous leaves and branches while the low N poplars, on the left, have smaller and paler leaves and no branches. Researchers are attempting to produce trees that allocate the applied N into stems instead of leaves.

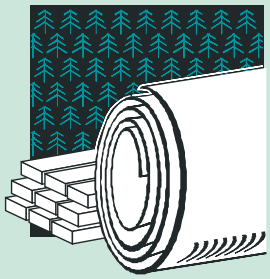
Project Description

Goal: Identify genetic and molecular processes controlling wood formation and wood properties.

Researchers will develop a "wood growth map" of genetic, molecular, and biochemical processes that control wood formation and wood properties. The effects of light and fertilization on the expression of the wood growth roadmap that controls wood formation and wood properties will be determined. Researchers will then produce and analyze transgenic poplars with increased capacity to import carbon resources into wood.

Progress and Milestones

- Under a previous Cooperative Research Agreement project with DOE, entitled *Molecular Physiology of Nitrogen Allocation in Poplar*, researchers completed a nitrogen response "wood growth roadmap" in poplar trees to assess how specific genes, anatomy, physiology, and biochemistry affect wood formation.
- The roadmap is now being used to assess poplar trees genetically engineered to potentially alter nitrogen allocation.
- Researchers identified that high expressing Rubisco transgenic lines of poplar should be perturbed in the N-response roadmap. Lines were analyzed for their Rubisco protein reduction performance and pertubation of the N-response roadmap.
- Investigators presented a talk at the International Plant and Animal Genome meeting (San Diego, CA) and published a manuscript in the *Canadian Journal of Forest Research* regarding findings from this project.
- Experiments will be conducted to alter the C:N balance of wood, and clones (genetic constructs) will be developed.



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